Requirements for a Behaviour Change Application for Alcohol Intervention and Reduction

University of Oulu
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Master's Thesis
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June 5, 2020

Abstract

The goal of this study was to find requirements for a behaviour change application for alcohol intervention and reduction. Motivation for the study comes from a preceding project work that studied a potential system that could be used to monitor and reduce alcohol consumption. The result of this project work suggested utilizing behaviour change theory for creating a mobile application to achieve the desired effect on the user. The study was conducted as a theory driven qualitative research study that gathered information from existing scientific research. The study utilized qualitative semi structured interviews and discussions from an online alcohol support forum for data gathering and analysis. The semi structured interviews were part of the previous project work and were also analysed for this study. Analysis for the forum discussions was done as content analysis.

The research found that the application should take advantage of suitable behaviour change techniques such as self-monitoring, having social support features or teaching the user coping skills. It should also maintain user's engagement by having aesthetic design, being easy to use or by having the option to give feedback on using the application. Further the application could use unique smartphone features to stand out from other digital alcohol support methods. Also, the application should provide evidence of successful behaviour change based on scientific data and be built by using established behaviour change application models.

The small number of interviewees was a limitation for this study. Also, using content analysis to get information about people who are actively seeking help for alcohol use was a limiting factor on getting more precise information. In the future a more comprehensive qualitative interview process could be conducted that includes a wide variety of different kinds of potential users.

Keywords
Alcohol use, mobile application, behaviour change

Supervisors
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Ph.D., Postdoctoral researcher, Pasi Karppinen

Foreword

I would like to thank my supervisors Tonja Molin-Juustila and Pasi Karppinen for giving me an interesting project and study topic. Despite not myself being very familiar with alcohol and substance abuse, I find it meaningful in having a topic that has the potential of helping many people improve their lives. I would also like to thank my project work partners Tuomas Liimatta and Lauri Laitinen who gave me the motivation to continue working on the topic. And finally, I would like to thank Tanja Vahter and everyone involved with Additionlink.fi; the moderators, users and support staff. I would not have been able to do this study without your help in finding out more about people who do have a real-world stake in my topic and could potentially benefit from it. Thank you all.

Johannes Riekki

Oulu, June 5, 2020

Contents

1. Introduction

The purpose of this study is to look at alcohol reduction mobile applications to better understand the unique requirements for mobile alcohol reduction and intervention. The motivation to study this topic comes from an earlier project work into the same general topic. The prior research and expertise gathered during the project work meant it was a natural to progress the topic towards further study. During this project, three semi-structured qualitative interviews were conducted. These interviews were used to create a concept for a mobile application that could be used to monitor or reduce a person's alcohol consumption. Based on the interviews, users value self-monitoring, tailoring, usability and social support, all techniques used in behaviour change theories such as the Transtheoretical Model (Glanz & Bishop, 2010). The fact that there is little research into using these different behaviour change theories in creating a such application means that further empirical data could be beneficial in creating a successful application (Crane, Garnett, Brown, West & Michie, 2015). Health promotion applications are already a well-established phenomenon in smartphone applications, (Aitken, as cited in Crane et al., 2015) however, helping people reduce and cope with alcohol consumption, especially when dealing with serious health issues, needs to be dealt with special consideration in mind (Meredith, Alessi & Petry, 2015; DeMartini et al., 2018). To find more about this issue, the main research question for this study was formulated as:

> What requirements can be identified for mobile behaviour change application for alcohol reduction and intervention?

During background research into scientific journals it was apparent that there were two main requirements for creating a suitable behaviour change application for alcohol reduction. According to Crane, Garnett, Brown, West and Michie (2017) using behaviour change techniques was not enough to create permanent behaviour change. It was also necessary to maintain user engagement by using specific strategies. From this realisation the main research question was further refined into two specific sub-questions to provide specific requirements for an alcohol reduction and intervention application. The sub-research questions are:

1. What kind of behaviour change techniques should they utilize?

2. What kind of user retention strategies should they utilize?

Qualitative research approach was selected because the need to further understand and study a relatively new topic in research. The goal was to use the interview data collected already during the previous project. In addition, new data was collected from a support forum for people who wanted to abstain or reduce their alcohol consumption. The discussions in this forum were studied by utilising content analysis. The interview data was re-analysed to provide new data in relation to the research questions. The discussions in the forum were analysed in a qualitative manner to dissect from them general themes and needs that could be reconstructed as requirements for a behaviour change mobile application.

As the previously conducted qualitative interview was conducted by interviewing users with some expertise in software development, the content analysis into an appropriate forum provided more rich information about people who are tackling real life substance use problems. Comparing the results of students of information processing science's opinions and alcohol problem users' comments provided a balanced result between

system and user requirements. This information was compared to scientific data gathered from various journals and publications to find out if current research supports the findings or if there are some issues missing or perhaps given too much priority. The results of this study can be then used to create a balanced behaviour change system in a mobile application setting to combat alcohol use related issues.

In chapter 2, the background research gathered from scientific journals into behaviour change and mobile interventions is provided. Chapter 3 presents the research methods used in this study. In chapter 4 the empirical results are presented both from the qualitative interview and the forum content analysis. In chapter 5 the results are presented as a whole and compared with the data gathered in the background research chapter. This analysis will provide with answers into the research questions. The final, and 6th chapter will provide a brief conclusion of the research and present the final implications of the study.

2. Background

The following chapters will explore behaviour change alcohol reduction applications, their special requirements and considerations based on published scientific sources. The initial results for the background research were found from Scopus and Google Scholar by utilizing search words “Alcohol reduction application”, “Behaviour change”. These results were further expanded by simplifying the key words into “Application”, “Mobile application”, “Alcohol” and “Intervention”. These search parameters provided several quality articles that were further assessment using the Finnish Publication Forum (“Publication Forum”, n.d.) scientific article evaluation tool. Two of the publication forums in the papers were ranked as 2 or “leading level” in scientific status and provided more than one results. These were the Journal of Medical Internet Research and Alcoholism: Clinical and Experimental Research. For further systematic review, these journals’ volumes and publications from the past three years were reviewed for relevant articles into the topic of alcohol reduction, behaviour change and mobile applications. The first chapter discusses the theories behind behaviour change and the basic function and structure of a behaviour change application. In the second chapter, previous research is reviewed about alcohol reduction and interventions used in conjunction with digital technologies. The third chapter explains the behaviour change techniques used in mobile intervention and reduction applications. The fourth chapter explains how to keep the users using the application long term. This user engagement is important to achieve a long-term behaviour change (Garnett, Crane, West, Brown & Michie, 2015).

2.1 Behaviour change applications

Spring, Gotsis, Paiva and Sprujit-Metz (2013) describe a foundation for a health application that can be used for continuous monitoring and intervention in unhealthy behaviours. The goal for health apps and other behavioural change interventions is to encourage health-enhancing activities, prevent or reduce activities that harm a person’s health (Spring et al. 2013). There are different target behaviours that can be influenced with health apps such as smoking, losing weight, exercising, and reducing alcohol consumption. According to Spring and colleagues (2013) the same proven theories that are based on social sciences function in mobile applications just as well as in face-to-face interventions. These behaviour change mechanics have been proven to work better than other non-scientific methods (Glanz & Bishop, 2010). The most popular and useful of these theories are the Health Believe Model, Transtheoretical Model, Social Cognitive Theory and Social Ecological Model (Glanz & Bishop, 2010).

Health Believe Model (HBM) suggests that a person’s beliefs about a health problem affect their likelihood of acting about said problem (Champion & Skinner, 2008). According to Champion and Skinner (2008) a person will take action to reduce their risks if they believe that they are at particular risk to a condition. They may also act if they think that that condition would have severe health implications. A person is more likely to act if they believe it would be beneficial to them or if they perceive that the benefit from the action out-weigh any associated costs or barriers. Another variable in HBM are cues, such as sneezes that can trigger actions in a person to take the action towards a realized risk (Champion & Skinner, 2008). However, Champion and Skinner (2008) note that such cues are difficult to study and have not been proven trough systematic research. Finally, self-efficacy, or the belief that a person can successfully take action to solve a problem, can affect how a person relates to a health risk according to HBM (Bandura as

cited in Champion & Skinner, 2008). Glanz and Bishop (2010) conclude that HBM is most beneficial when studying health implications that do not have immediate and apparent symptoms such as in early cancer detection.

Transtheoretical Model (TTM), suggests that there are six different stages that to progress when trying to achieve a long-term change (Prochaska, Redding & Evers, 2008). First of these stages is precontemplation, where a person has no intention to act within the next six months. Second stage is contemplation, where a person intends has made the decision to act within the next six months. Next is preparation, when a person is committed to act during the next month and has done some preparations to do so. After preparation comes action, where a person has managed to change their action less than six months. This is followed by maintenance, where the change has been maintained for over six months. And the final stage, termination, when the temptation has been overcome and there is no change of relapse (Prochaska, Redding & Evers, 2008). The authors also present the ten different processes of change (Prochaska, Redding & Evers, 2008). First of these is consciousness raising, that means to search for information to benefit the behaviour change. Dramatic relief means associating negative emotions to the undesired behaviour. Self-re-evaluation is a process where person comes to realize that the change is an important part of their live and identity. Environmental re-evaluation is achieved when the person realizes the effects of the behaviour change and the undesired behaviour to their physical and social environment. Self-liberation is achieved when the commitment to change has finally been made. Helping relationships are using one's social support networks to help change. Counterconditioning means to seek out a healthier option to the bad behaviour. Reinforcement management means using rewards for good behaviour. Stimulus control can be used to make sure there are no cues or reminders that may enact bad behaviour. Finally, social liberation is a process where a person comes to realize that the social norms around them support healthy behaviour. TTM also takes into consideration the benefits, costs, and self-efficacy of behaviour changes for the person (Prochaska, Redding & Evers, 2008; Glanz & Bishop, 2010).

Social Cognitive Theory (SCT) suggests that a person behaviour is continuously interacted and affected by personal factors and environmental influences (Wood & Bandura, 1989). The goal of SCT is for the person to alter their own environment to benefit themselves and potentially the collective (McAlister, Perry & Parcel, 2008). The key concepts in SCT are reciprocal determinism, outcome expectations, self-efficacy, collective-efficacy, observation learning, incentive motivation, facilitation, self-regulation, and moral disengagement (McAlister, Perry & Parcel, 2008). Reciprocal determinism means how people affect the environment and vice versa. Outcome expectations are beliefs about the value of change and the likelihood of its success. Self-efficacy is the persons believe that the behaviour change can be achieved. Collective efficacy is the same as self-efficacy but for the collective. Observational learning means learning new behaviour from observation. Incentive motivation is the use of rewards and punishments. Facilitation cam be using tools and resources to help the change. Self-regulation are methods such as self-monitoring, goal setting, feedback, rewards, self-instructions, and social support. Morally disengaging one's moral compass can lead to excusing bad behaviour that harms oneself and others. For interventions, self-monitoring and goal setting have been proven to be very beneficial (Glanz & Bishop, 2010).

Social Ecological Model takes into consideration the use of social environments to draw guidance for behaviour change and development of beneficial programs (Glanz & Bishop, 2010). The core idea of the social ecological model is to create a social environment that supports and caters to healthy behaviour and disfavours bad behaviour (Sallis, Owen & Fisher, 2008). Educating people to make good choices is good for the short term,

however, changing the environment to support these choices can lead to greater long-term effects (Sallis, Owen & Fisher, 2008). In Social Ecological Model the change can be made from the ground level, from changes in families and small communities, to larger government policies that support the individual's behaviour change (Sallis, Owen & Fisher, 2008). According to Bandura (as cited in Glanz & Bishop, 2010) Social Ecological Model and Social Cognitive Theory are consistent with each other.

Spring and colleagues (2013) propose that a successful health application should not only take advantage of the well-established behavioural science theories but also use the possibilities brought on by modern smart devices to create a real-time intervention health application. Previous intervention methods have heavily relied on fixed sequence of sessions based on established intervention manuals. These kinds of interventions are slow to react to the clients changing states of self-efficacy, whereas mobile applications can use both objective and subjective real-time data to adapt to the client's needs (Spring et al., 2013). To create such application, Spring and colleagues (2013) have devised a model called "4 Ms": monitoring, modelling, motivating, and modifying (Fig. 1). Monitoring is used to gather data about the user to determine how the persuasion is working in relation to the persuasion change plan, from the data a model can be created to determine how the behaviour works in real-time, the behaviour can then be modified, or changed to a healthier option and motivation is the force that drives the user to track their behaviour and change it accordingly. The process is iterated in real time to reflect the users changing behaviour and collected data. (Spring et al., 2013.)

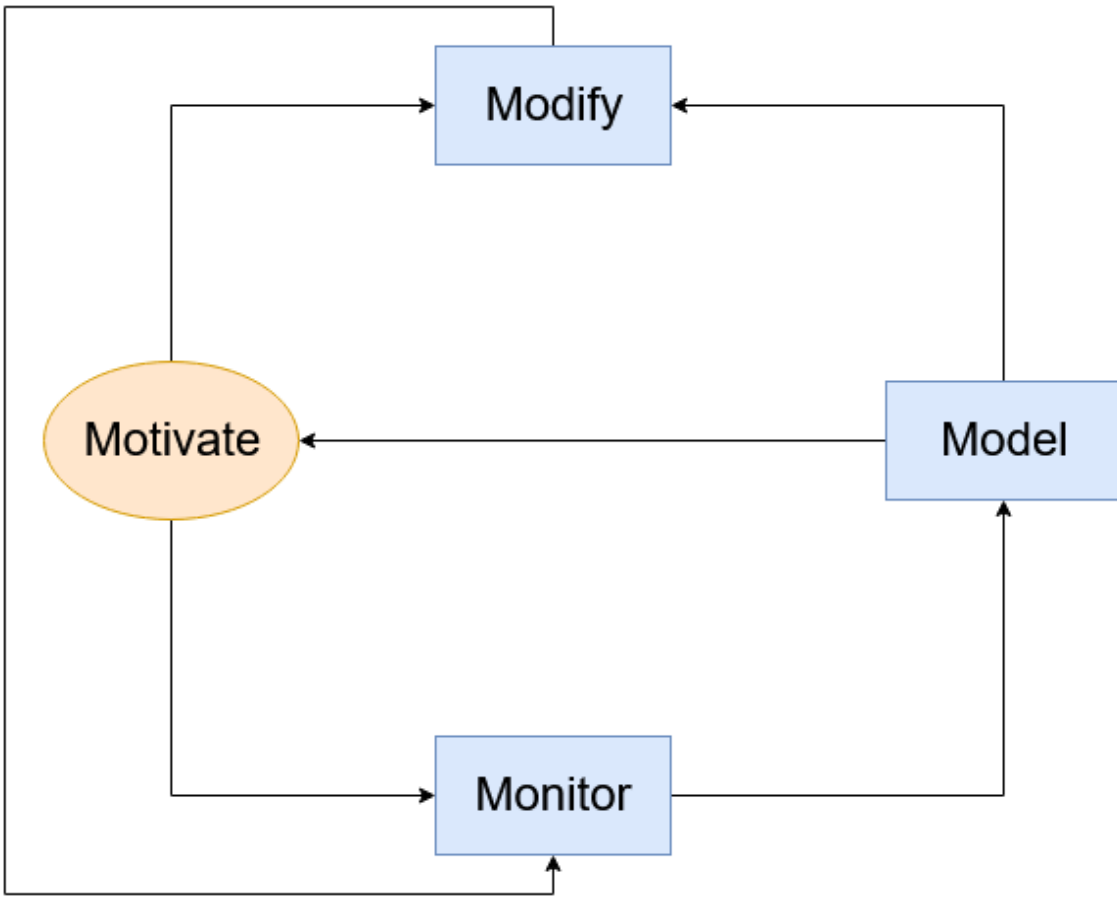

Figure 1. "4 Ms" model created by Spring, Gotsis, Paiva and Sprujit-Metz (2013).

With the advances in wearable, implantable, environmental sensors and mobile technologies, a health promotion application can gather various forms of data passively

through the application or, directly from the user in real time (Spring et al., 2013). Monitoring can also be conducted via entertainment apps when gathering data from the user via back-end technologies. According to Spring and colleagues (2013), this kind of granular data gathering can be used to derive algorithms that are able to even predict the user's behaviour to predict lapses and take preventative measures through the application. With these advanced monitoring methods, the application can then create, or model, an effective behavioural change strategy in-real time, based in the appropriate behavioural change strategies (Spring et al., 2013).

Spring and colleagues (2013) note that the key in any behaviour change plan is to motivate the user into taking advantage of the behaviour change plan. According to the authors, there are three key challenges in motivating a user (Spring et al., 2013). Firstly, the user must be motivated to self-monitor or be monitored by someone else. Secondly, the user must be motivated to want to change their behaviour and lastly, the person must be motivated to maintain the positive behaviour achieved through the change. Motivating self-monitoring can be done via personalization, competition and supporting social interaction between users. The application can also take advantage of narration, storytelling, and intuitive interaction to maintain motivation to use the application. A key is also to avoid using strategies that may make the user to think that they are being controlled to change their behaviour, i.e. using compliance techniques. (Spring et al., 2013.)

Modifying takes place based on the modelled behaviour by using any chosen behaviour change techniques (Spring et al., 2013). Ideally, these persuasion techniques follow the established behaviour change theories mentioned above. These can be using self-monitoring, rewarding the user, setting goals, giving feedback, improving self-efficacy, and building copings skills. A key is also to make using the application as effortless as possible and easy-to-use to motivate self-monitoring. The challenge in creating an application that models the persons behaviour is that in computer sciences, predicting a person's behaviour is typically modelled with data gathered from the user in a "bottom-up" manner, while in behavioural sciences behaviour is predicted based on known theories. Using an iterative process, like the 4 Ms, can be used to gather data and simulate more accurate behaviour models. Data from such applications can even be used to further improve the existing behavioural science theories to maintain their accuracy and usefulness. The principles of the model are designed to be used in creating various types of health application including weight loss, quitting smoking, improving diet, physical activity or reducing alcohol usage. (Spring et al., 2013.)

2.2 Digital alcohol intervention and reduction

Although face-to-face intervention methods have been proven to be effective, the use of digital intervention methods have increased because of the low cost of delivery when compared to traditional interventions (Wallace & Bendtsen, 2014). Using digital devices have already proven to be useful when tackling other health issues such as smoking and combatting depression and anxiety. There is already some limited proof that approaching problem users via digital methods can have benefits in relation to alcohol use. In some settings, digital methods have already been proven to be as effective in combatting alcohol related health problems as regular interventions. (Wallace & Bendtsen, 2014.)

There have been several pilot studies that combine digital intervention for alcohol use and primary care providers (Wallace & Bendtsen, 2014). In Sweden between 2007 and 2010, 28 primary health care centres had computers with alcohol screening and brief

intervention modules installed. These modules contained questions about the persons alcohol usage behaviours and then compared it to the recommended drinking limits. They also utilized a self-monitoring and a drinking diary. The information provided by the user and their motivation to reduce usage then provided them with appropriate suggestions for reducing their drinking. The systems themselves were stand-alone computer kiosks that handled the user's data completely anonymously. The staff was trained to refer clients to the kiosks, but users were also allowed to use the system independently. Subsequent study into the pilot project showed that the system was able to reach a sizable group of people. Also, many of the identified risk users who agreed to partake in a follow-up interview remembered the information provided by the system and found it to be relevant. However, the authors believed the program to be ineffective as staff engagement and support for the kiosks were low and their use declined after initial success. (Wallace & Bendtsen, 2014)

Another trial in the United Kingdom called Down Your Drink, combined human interaction with web-based intervention (Murray et al., 2012). The programme was conducted in three phases and utilized techniques known to be effective in a face-to-face setting. The targeted users were adults over the age of 18 who had been identified as hazardous or harmful drinkers. They had volunteered for the program through referral by their general practitioners. The first phase, called "It's Up To You", was a interview process with the goal of motivating the users to change their drinking habits. The second phase, "Make the Change", utilized the web-based cognitive behaviour therapy sessions and self-control techniques. The third phase named "Keeping on Track" was to maintain the user's engagement and prevent relapse. The users received personalized profiles with usernames and passwords and were provided with assistance from a co-ordinator for using the system. The co-ordinator also provided the user's help when needed to use the system and set up phone-based guidance for using the system in regular intervals. The pilot programme was hampered with limited budget and the designated co-ordinator leaving mid programme and was thus unable to get a hold of all the already-few-in number test users. However, the results of the intervention were positive regarding the interviewed test users reducing their alcohol usage and the costs were far lower than in face-to-face interventions requiring a larger number of highly trained professionals. (Murray et al., 2012) Wallace and Bentsen however noted that, the system was too costly for full scale implementation because the need of a co-ordinator to be trained and hired and because the programmer required time from doctors and nurses to screen and refer patients towards the programme (2014).

There is also data to suggest that digital resources have already been successfully used to combat problematic alcohol use (Bergman, Greene, Hoeppner & Kelly, 2018). Bergman and colleagues (2018) studied the prevalence of online technologies in recovering from alcohol and other substance abuse. Their data showed that, in the United States, as documented by the National Recovery Study (NRS), nearly 7% of people to recover from substance abuse had used social network sites to support their recovery. Unfortunately, the authors were unable to map the level of engagement of the recoverees with these sites or whether they could be built into a specific online support site for alcohol recovery use. The data also showed that 1 in 25 of the analysed persons had taken advantage of online based mutual-help organizations. The data did not specify the level of use in mobile applications, however, 6% of the persons to resolve their substance use issues did mention using other online resources. This would indicate that mobile applications were also used to help recovery. Bergman and colleagues (2018) study also listed the most likely users of online resources for recovery. Their data showed that the most likely users for such resources in the US were younger, with lower education, lower income, and people who, generally, had harder time accessing other recovery resources. They also noted the

possibility that use of online resources for substance abuse recovery may correlate with increased changes of developing “internet addiction”. (Bergman et al., 2018)

Short-message service (SMS) messages have also been studied in use for alcohol interventions (DeMartini et al., 2018; Suffoletto & Scagleone, 2018). Patients with alcoholic liver disease who were awaiting liver transplant were sent three SMS text messages a day for four weeks and later three messages per week for another four weeks to help them avoid relapsing. The messages contained motivational content and tailored behaviour change messages. The messages were aimed at addressing cravings, helping with mood changes, identifying high-risk situations and triggers for relapsing, and improving coping and drink refusal skills. Furthermore, some messages included positive recommendations relating to healthier lifestyle such as exercising and improving the patients’ diet. The results of the study showed that patients were successful in maintaining their abstinence and stress levels with the help of the motivational, and instructive SMS messages. This is especially important for liver transplant patients as patients are usually required to remain abstinent for at least six months prior to receiving a transplant, further complicated by the patients’ problems with alcohol abuse. (DeMartini et al., 2018) Suffoletto and colleagues (2014) conducted a similar test for using SMS messages to reduce binge drinking with young adults. The study used two different approaches, one that only sent messages at the end of the week to the participants to report their weekly drinking, and another where the participants were sent queries about alcohol usage twice a week with real-time feedback also being provided based on the answers (Suffoletto et al. 2014). The results showed that in neither case, were SMS messages particularly useful in reducing drinking with young adults (Suffoletto et al. 2014).

Using mobile applications can be especially beneficial when used by people who are at even greater risks from alcohol use like people diagnosed with alcohol use disorder (AUD) (Meredith et al., 2015). These types of people require ready-at-hand intervention and coping tools to combat their alcohol use when traditional support methods are not reachable on time (Meredith et al, 2015). Meredith and colleagues (2015) concluded that despite very little research placed on commercial alcohol reduction applications, the evidence of their usefulness in the hands of both people who are receiving AUD treatment and people who are yet to be diagnosed are undeniable. Indeed, a great benefit for using mobile reduction applications is their accessibility and ability to be tailored on the go for each individual user (Meredith et al., 2015).

2.3 Behaviour change techniques in intervention and reduction applications

A key in understanding how to develop an application for alcohol reduction is to understand what behaviour change techniques are suitable for alcohol reduction (Cohn, Hunter-Reel, Hagman & Mitchell, 2011). As there are several already existing applications aimed at reducing alcohol consumption, one possibility is to map the behaviour change techniques used in these already-existing applications (Cohn et al., 2011; Garnett, Crane, West, Brown & Michie, 2015). Furthermore, of importance is to determine whether the identified behaviour change methods are based on theories known to be useful in alcohol reduction and intervention. There have been several studies into finding out what kind of applications are available for mobile users and what kind of behaviour change techniques they utilize (Cohn et al., 2011; Garnett et al., 2015; Crane, Garnett, Brown, West & Michie, 2015). According to several studies, most applications marketed towards alcohol users are designed for entertainment and have the opposing motive to helping people monitor and reduce their usage (Meredith et al., 2015; Weaver,

Horyniak, Jenkinson, Dietze, & Lim, 2013; Zhang, Ward, Ying, Pan & Ho, 2016). Even with applications that are designed to monitor alcohol intake, such as alcohol trackers and body alcohol calculators, there is a risk that they may inadvertently increase consumption as users may use them for competition with one-another (Weaver et al., 2013). Trackers, however, are one of the most common, and simple form of application for self-monitoring alcohol usage (Zhang, Ward et al., 2016). Their benefits when used appropriately are well based in alcohol intervention and behaviour change theory (Zhang, Ward et al., 2016). Zhang, Fang and Ho (2016) noted that, alcohol trackers can be effectively used in mobile devices to reduce alcohol usage and increase the user's awareness to substance abuse. Other studies, however, show that mobile interventions alone are not enough, but that further face-to-face interventions are required for successful behaviour change in alcohol consumption (Hamamura, Suganuma, Ueda, Mearns & Shimoyama, 2018).

Cohn, Hunter-Reel, Hagman and Mitchell (2011) collected data from several applications retrieved from Apple iTunes store for mobile devices. They found that, from over 700 applications retrieved only about a third were directly related to alcohol reduction or intervention (Cohn et al., 2011). Ten percent of the applications that were intended on reducing alcohol use did not use any scientific reduction methods (Cohn et al., 2011). They were able to identify motivational counselling, coping and self-control, social support and applications that provided information about alcohol policy, such as legal blood alcohol limits for driving. Techniques based on cognitive theory were not present in their dataset (Cohn et al., 2011). Hoeppner and colleagues (2017) further studied the available applications this time from Google Play store for android applications. They discovered several blood alcohol concentration (BAC) calculators as well as alcohol tracking calendars, motivation booster apps, games to distract from cravings and apps that provided information about alcohol use. Mubin, Mahmud and Kabir (2016) did not only identify several alcohol reduction applications from Apple iTunes, but also studied the comments made about the applications in the iTunes store. They were able to identify 18 apps in the application store that utilized self-control or self-coping and motivational counselling (Mubin et al., 2016). The dataset from the comments showed that users preferred self-control strategies over motivational counselling as they were found to be more subtle and less controlling (Mubin et al., 2016). Further, the comments showed that users preferred gradual reduction goals and customization of the application and the features (Mubin et al., 2016). Feedback on the achieved behaviour change was highly preferred and social interaction was deemed beneficial (Mubin et al., 2016). Some users also noted that combining the alcohol reduction with other reduction for unhealthy behaviour within the same application could prove helpful (Mubin et al., 2016).

Garnett, Crane, West, Brown and Michie (2015) were able to identify twelve effective behaviour change techniques for alcohol reduction. Garnett and colleagues (2015) used formal expert consensus method to interview seven academic experts into alcohol literature and behaviour change interventions about suitable behaviour change techniques. Four of the twelve behaviour change techniques were particularly suitable for alcohol reduction in mobile applications. These were self-monitoring, goal setting, action planning and feedback in relation to goals. The expert consensus also verified that the same techniques that are effective in face-to-face interventions (self-monitoring, goal setting, action planning, and feedback in relation to goals) should work for mobile applications, as well. (Garnet et al., 2015.)

A study by Crane, Garnett, Brown, West and Michie (2015) studied popular alcohol related apps in the UK. Their aim was to identify any behaviour change techniques the applications may draw from and whether they mention theory or evidence to support their behaviour change claims. Further, the authors wanted to find out if the use of established

behaviour change techniques, theories and presented evidence affected the applications popularity and user ratings. Based on the analysis, none of the applications mentioned theory and only 16.4% of the applications mentioned evidence to their claims, usually based on nationally recommended alcohol consumption amounts. Although most of the apps used some behaviour change techniques, almost half used only three or less techniques per application. Less than ten percent used more than ten techniques. The most common behaviour change techniques were self-monitoring, providing information about excessive use and reduction, giving feedback, providing options for additional support and offering links to additional written material. Other mentioned techniques were tailoring, boosting motivation and self-efficacy, prompting review of goals, giving rewards on success and facilitating goal setting. The results showed that the use of behaviour change techniques had only very little effect on the popularity and user scores. (Crane et al., 2015)

Tofighi, Chemi, Ruiz-Valcarcel, Hein and Hu (2019) identified several applications from Google and Apple stores. The authors also rated these applications by utilizing validated Mobile App Rating Scale (MARS). Their research showed wide variation between applications available on the application stores. The highest rated applications utilized goal setting, self-monitoring, links to other services, notifications, social-support, links to written material, teaching coping skills, providing information about substance use and overdose, and giving out rewards. Tofighi and colleagues (2019) were also able to identify a single application that utilized a proven evidence-based psychotherapeutic approach; however, this was proven to be poorly executed and its satisfaction and design scores were sorely lacking. No application was found to provide any empirical evidence to prove their effectiveness in combatting substance abuse. This is rather worrisome as others have noted that, although there is potential in using a mobile application to combat substance, incorrect use of any such application can cause the user harm as substance abuse is still a medical issue (Choo & Burton, 2018). (Tofighi et al., 2019.)

In their paper, Garnett, Crane, West, Brown and Michie (2019) describe the creation of a smart-phone application called “Drink Less” aimed at excessive drinkers. Garnett and colleagues (2019) decided to use a design principle based on an approach called Multiphase Optimization Strategy, designed for behavioural interventions (Collins, Murphy, Nair & Strecher, 2005). The typical multiphase strategy consists of three phases: the screening phase, the refining phase, and the confirming phase (Collins et a., 2005). For designing the application Garnett and colleagues (2019) used two design phases. The first face was to select the intervention components. This design phase utilised scoping review, expert consensus study and content analysis into already existing applications to find suitable components. These components were then implemented into modules in the second phase and reviewed for use in the application. This second phase involved an iterative process based on agile methodology, where the components were inserted into a suitably appealing test application for both, informal and usability testing. Garnett and colleagues (2019) were able to identify five suitable intervention strategies for the application: normative feedback, cognitive bias retraining, self-monitoring and feedback, action planning and identity change.

Next, a table has been prepared with a collection of the behaviour change techniques from the scientific sources presented above. This is presented as Table 1.

Table 1. Identified behaviour change techniques in alcohol reduction applications.

Behaviour change technique	Explanation	Publication
Self-monitoring	Using self-tracking, self-monitoring, and alcohol counters to monitor usage.	Attwood et al. 2017, Crane et al. 2015, Garnett et al. 2015, Garnett et al. 2019, Hoeppner et al. 2017, Mubin et al. 2016, Tofighi et al., 2019
Providing feedback	Providing feedback on behaviour change and progression in relation to goals	Attwood et al. 2017, Crane et al. 2015, Garnett et al. 2015, Garnett et al. 2019, Mubin et al. 2016, Mubin et al. 2016
Boosting self-efficacy/motivation	Boosting one's motivation and belief that the behaviour change is attainable and successful.	Cohn et al. 2011, Crane et al. 2015, Hoeppner et al. 2017, Mubin et al. 2016
Goal setting and review	Ability to set goals for alcohol reduction and the ability to review progress.	Attwood et al. 2017, Crane et al. 2015, Garnett et al. 2015, Mubin et al. 2016, Tofighi et al., 2019
Social support and comparison	Using social tools such as comparison, games, trophies, and social interaction to help change.	Cohn et al. 2011, Mubin et al. 2016, Tofighi et al., 2019
Action planning	Creating pre-planned actions that can be taken when faced with risk situations.	Garnett et al. 2015, Garnett et al. 2019
Providing information about alcohol use and reduction	Providing information about the dangers of alcohol abuse and ways to reduce usage effectively.	Crane et al. 2015, Hoeppner et al. 2017, Tofighi et al., 2019
Teach coping skills	Teaching skills that help coping with cravings and abstinence.	Cohn et al. 2011, Suffoletto & Scagleone, 2018, Tofighi et al., 2019
Giving out rewards for success	Providing rewards for achieving goals and behaviour change.	Crane et al. 2015, Tofighi et al., 2019
Providing additional support	Providing an option to receive more support when needed.	Crane et al. 2015, Tofighi et al., 2019
Links to written material	Links to written materials from trusted sources about alcohol use and associated risks.	Crane et al. 2015, Tofighi et al., 2019
Cognitive bias retraining	Using stimuli to train the mind's automatic biases to avoid alcohol related cues.	Garnett et al. 2019
Identity change	Helping people change their identity to not include alcohol or alcohol related actions.	Garnett et al. 2019
Tailoring	Ability to change the application and behaviour change methods.	Mubin et al. 2016

The table also provides a short explanation of the behaviour change techniques and lists the publications where the behaviour change technique was mentioned. The behaviour change techniques in the table are sorted based on the number of publications they were found in.

2.4 Engagement and user retention strategies in intervention and reduction applications

As mobile health applications have been proven to have high user attrition rate it is important to monitor and improve users' engagement with the application to help user retention (Garnett et al., 2015). Suffoletto and Scaglione (2018) note that the optimal duration of a digital intervention into alcohol use disorder varies between individuals. The digital intervention should take into consideration the users' requirements and expert estimates (Suffoletto & Scaglione, 2018) In their study, Garnett and colleagues (2015) also mapped the experts views on suitable engagement, or user retention strategies to maintain user engagement. The most important user retention strategies were ease of use, design of the application that was aesthetically pleasing, being able to give feedback on the content, the application had to be very functional, being able to tailor both the design of the application and the information that it provided and utilizing unique features made possible by smartphone technology. (Garnett et al., 2015)

When testing the Drinkaware app, Attwood, Parke, Larsen, and Morton (2017) were also able to identify a high attrition rate in users just after one week. The researchers mapped the motivation for users downloading the application and found that the people who downloaded the application specifically to reduce their drinking, versus those who were only curious about the application, were more likely to continue using the application. It was also noted that high risk drinkers, who were also more than likely to be already motivated to reduce drinking, continued using the application after the initial user attrition. These users were also more active in using the applications various behaviour change techniques such as goal setting, self-monitoring and setting up warnings for risk locations. The users reported that feedback and goal setting were viewed beneficially and that options to tailor the information and the goals were desirable improvements whereas some features like setting risk location was found confusing and unnecessary. Majority of the users found the application to be easy to use, that also helped user retention. (Attwood et al., 2017)

Crane, Garnett, Brown, West and Michie (2017) also conducted an assessment about alcohol reduction with an application called Drink Less. The application used goal setting, self-monitoring, feedback, identity change, cognitive bias retraining, action planning and social comparison as its behaviour change techniques (Crane et al., 2017). Their goal was to assess the applications usability. After interviewing the participants of the usability test, the authors found several requirements from the users regarding usability. These were the need for the application to be easy to use and beneficial, the need for guidance during first use or when adding data, entering data should be simple and intuitive, there shouldn't be too much data presented to the user, the application should be rewarding to use and it should provide information for the user on how it intends to help them. Aesthetics were also an important factor for ease of use. (Crane et al., 2017)

Table 2 is provided to list all the user retention strategies used to maintain user engagement. These, as in table 1 are collected from the above scientific sources.

Table 2. Identified retention strategies in alcohol reduction applications.

User retention strategy	**Publication**
Ease of use	Attwood et al. 2017, Crane et al. 2017, Garnett et al. 2015
Professional and aesthetic design	Crane et al. 2017, Garnett et al. 2015
Feedback on content	Attwood et al. 2017, Garnett et al. 2015
Function	Crane et al. 2017, Garnett et al. 2015
Tailoring the information	Attwood et al. 2017, Garnett et al. 2015
Limiting the amount of data presented	Crane et al. 2017
Rewarding use	Crane et al. 2017
Perceived benefits from use	Crane et al. 2017
Intuitive use	Crane et al. 2017
Providing help in use when needed	Crane et al. 2017
Openness/transparency	Crane et al. 2017
Utilizing unique smartphone capabilities	Garnett et al. 2015
Tailoring the design	Garnett et al. 2015

These user retention strategies are based on the various system quality features and design principles that relate to the long-term use of the behaviour change application. Although Garnett and colleagues (2015) specifically discuss them as user engagement strategies, for the sake of clarity, they are listed here as user retention strategies as they pertain to making sure users continues using the application and take full benefit of the behaviour change techniques they utilize.

3. Research Methods

This chapter will explain the research methods used in this study. The study utilizes theory-driven qualitative research method (Jennings et al., 2019). This method was chosen as the desired system should use behaviour change theory and as the research into the requirements for this system is done in a qualitative manner. The study was conducted using two types of data. The first data gathering method was to use three previously conducted interviews done for a research project. This research project was done to find out what kind of system could be used to help people monitor and reduce their alcohol consumption. The results from this research led to a creation of a concept mobile application that utilised behaviour change theory. The previously conducted interviews were further analysed to provide more information for this study, as well. Another new set of data was gathered from forum posts form an alcohol reduction related forum to find out specific comments that could provide insight into the special requirements from people wanting to reduce their alcohol consumption, in relation to building a purposeful alcohol reduction application. The comments from this forum were analysed in a qualitative manner to discover themes and topics that could be constructed as requirements for a potential mobile application. The first chapter introduces the background project and its results. These are meaningful as they relate to the interviews that are also used for this study. The second chapter explains the qualitative interviews and how they were conducted for the project and further analysed for this study. The third chapter presents the gathering of the empirical data from the forum and how its content was analysed.

3.1 Background project

The background project work that was the motivation for this topic was conducted during the “Research and Development Project” for the University of Oulu. The customers for this project were Tonja Molin-Juustila and Pasi Karppinen. Their requirements for the project were to receive a concept for system that could be used for reducing the user’s alcohol consumption. The team’s guidelines into creation or innovating this application were very broad. No specific type of platform or form of system was specified. However, the team during their iterative process of studying the theory and available tools, settled on creating either a mobile alcohol use diary, a social support forum, an application for self-monitoring alcohol intake or a tool that utilized gamification or storytelling to help with cravings.

The team tested and analysed these potential applications and settled on creating a single paper concept application that included elements from all of these. The concept application could accept the users daily and weekly intake and present data from this intake. It utilized tailoring and customizability to help personalize the user experience and included a customizable avatar to provide with information and tools for reduction. The concept application supported goal setting and used notifications to maintain user engagement. The paper concept was then tested inside the team to see if it was suitable for example user evaluation. For the user evaluation, a semi structured interview process was chosen by the team and the customers. Twelve students from the University of Oulu Faculty of Information Technology and Electrical Engineering were approached to partake in the interview. From these invitations four students initially agreed to participate, but one had to cancel because of prior engagements.

The interview process showed that several elements were promising for the application and that many of the tools or features needed to be streamlined and changed to help with usability and user retention. A key point was that using the application on the go was to be made as effortless as possible, so a widget tool was also added into the concept. This tool could be used to easily add different alcohol servings consumed into the diary. Other improvements were to the amount of data presented to the user. The form of the graphs that showed the users' goals and progress were made customizable by the user. These improvements were refined into a digital visual representation that was companied by a video demonstration into the various features of the application. The video, the final paper concept, and all the research data was collected into a portfolio and was provided to the customers for further evaluation and research. The customers were satisfied by the provided data and concept and the project was deemed worth further research and development.

As an example of the concept applications used in the interviews, figures 2, 3 and 4 are presented here. These chosen features and elements were the results of project teams internal testing and analysis. The concepts were printed out in paper and presented to the interviewees during the interview discussions.

Figure 2. Example of the concept's diary function, notification, and avatar.

Figure 2 shows the diary function of the application. With it, users could keep a diary of their alcohol consumption. This gathered data could then be monitored by the user to see how their alcohol consumption changed over time. The second screen in figure 2 shows the application sending the user a notification. This notification is a congratulatory reward for the user for achieving a goal they had set for themselves. The third screen capture shows how the user's progression towards their goal and introduces the avatar used in the application. This avatar can provide various kinds of information and positive comments to boost the user's motivation.

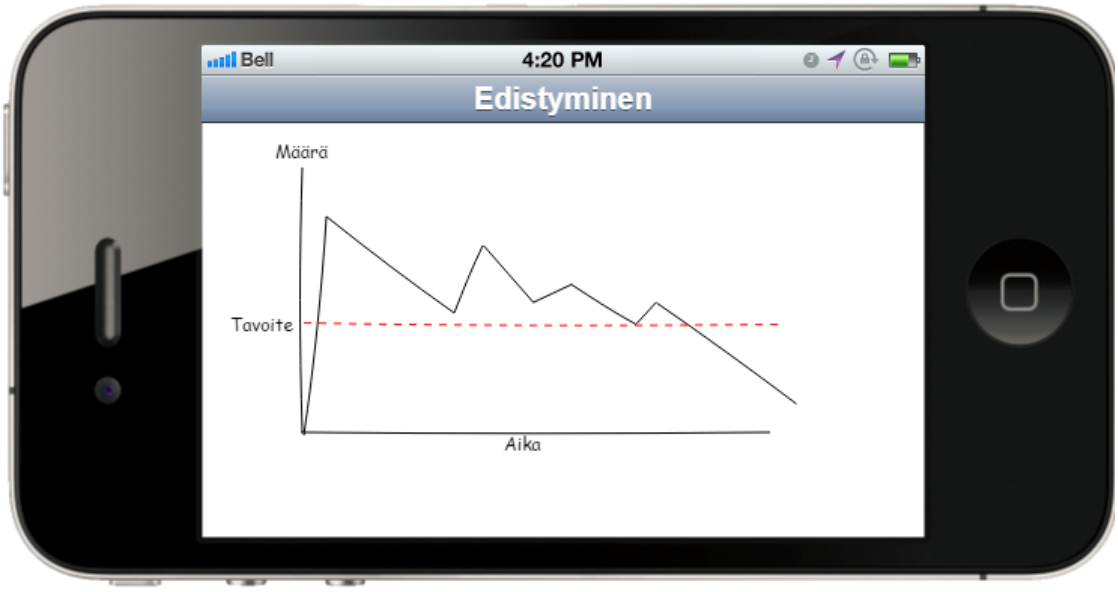

Figure 3. Further example of the concept showing graph constructed from self-monitoring data.

Figure 3 shows the graphical presentation of the self-monitoring data gathered with the diary function. The concept supported using various graphs and charts to present the data to the user. This example shows a simple line chart that presents the progression of time in the x axis and the number of servings consumed in the y axis. The red line presents the goal number of servings the user wants to reduce to.

Figure 4. Notifications and avatar providing information as presented in the interview.

Figure 4 shows the different ways the application can provide additional information to the user. The first two screens show notifications. The first notification is a link to a

reliable outside source that the user may use for additional support. The second screen shows an invite to an alcohol-free event that the user has received through the application's social support functions. The third screen represents the avatars use in providing the user with additional support in the form of a link to a reliable outside source of information.

3.2 Qualitative interviews

According to Hove and Anda (2005) qualitative interviews are often used when researching software development related issues. There are several approaches to qualitative interviews for software development (Seaman, 1999). There is the use of structured interviews, where the questions are presented by the interviewer and the answers come solely from the interviewee based on the very specific questions (Seaman, 1999). Another approach is to use unstructured interview approach, where the questions are as open-ended as possible, or the topic is only broadly refined and the questions are structured based on the responses given by the interviewee (Seaman, 1999). The interview process used in the qualitative interviews of this study used a semi structured interview approach. A semi structured interview process includes both specific and open-ended questions (Seaman, 1999). This is so that the interviewer can also prepare questions related to very specific ideas within the topic, but also provide opportunities for the interviewee to present ideas and information that are not defined by the presented questions or identified beforehand (Seaman, 1999). During the qualitative interview conducted in the previous project work, the questions were separated into three different sections. The semi-structured interview questions are presented as appendix A. The first section was more general information about the interviewee, the second section was a more open ended inquiry into the users alcohol usage habits and the final section was a set of questions into the application concept that was used as informal guidelines to guide the discussion, rather than to inquire directly from the interviewee.

The concept for the reduction application was presented in paper from where various functions and pages of the application were visualized in a simple mobile device UI layout. The interviewers were free to explore the concept papers after the initial background interview questions were discussed. The interviewees were free to ask questions about the concept and explore the various functions and their uses and functionalities. The interviewer and facilitator presented answers and explanations to the use of the application and how the user could interact, use, and modify the envisioned application.

In addition to the actual interview, there are several activities that facilitate the actual semi structured interview (Hove & Anda, 2005). It is important to schedule all the interviews before hand and to carefully select the interviewees. A good practice is also to study up on the interviewees and to collect and study background information to make sure the interviewees fill all the requirements for the topic and the research questions. It may also be necessary to train and prepare interview guides to make sure all interviews run smoothly, and the guides are on top of the subjects. It is also beneficial to conduct discussions and meetings with the researchers before, between and after each interview. Summarizing and transcribing the interviews is also an important task as it may require considerable time per interview and the number of interviews may vary. (Hove & Anda, 2005.) The project interviews were scheduled to take place during a two-week period. The time was chosen to be most suitable for the interviewees. Location for the interviews was a project workspace that was altered to give more space by moving unnecessary

tables and chairs. The team held several meetings prior, during and post interview process and a preliminary test interview was conducted internally by the project team.

Further consideration should be placed on the interviewer, the number of them, and their appearance and behaviour (Hove & Anda, 2005). Using two interviewers may result in longer interview sessions and, thus, further data. In a semi structured interview, one person may act as the main interviewer while the other takes notes and offers further questions or cues when it is appropriate. Using two interviewers naturally leads to more questions asked, as both interviewers have their own viewpoints, and reduces the burden when dividing the responsibilities during the interview. The interviewers may also discuss and verify their interpretations based on the interviewees answers and confirm whether they have understood the interviewee correctly. (Hove & Anda, 2005.) The qualitative interviews in the project work utilized thee persons: a facilitator, a note taker, and a main interviewer. The main interviewer asked the questions, however, the note taker also helped to maintain the conversation. Further, during one of the interviews the interviewer was changed to provide more rich data with different interviewers.

There are also several good interview practices that the interviewer needs to understand and master. It is important to be able to encourage the interviewee to talk freely and not be afraid to bring out issues they may find insignificant (Hove & Anda, 2005). Further, the interviewer needs to be able to ask relevant and meaningful questions and following up on any interesting topic that emerge from the interview process. Another important aspect in an interview is to make sure that the interview process is tidy and professional, in both preparation and in how to handle the personal data gathered during the interview. The interviewer needs to be polite and make sure they present themselves accordingly. The interviewer can either dress formally to enact a serious professional atmosphere or dress casually to appear more approachable. It is important also to be well prepared for the interview and to be open about the questions and let the interviewee view the questions beforehand. The interviewer can also use humour and laughter to further the interview if necessary and use informal language before and after the interview to relax the atmosphere. It is important also, not to argue and show interest in the interviewee's answers and comments. (Hove & Anda, 2005.) The interview process in the project interviews were very formal yet friendly. Several of the interviewees were already familiar to the project team, so during the interview, a more formal approach to the questions were initially taken to avoid too friendly of an approach.

Much consideration should also be placed on the type and nature of questions presented to the interviewee (Seaman, 1999; Hove & Anda, 2005). A good practice is to use questions that the interviewee cannot answer either "yes" or "no" but to use as open ended questions as possible (Seaman, 1999) or to lead the questions with very specific ones and to follow up on those with more general ones or conversely, if suitable (Hove & Anda, 2005). Another way to further interview is to feign ignorance when presented information from the interviewee that is already familiar to the interviewer from previous expertise or interviews and letting the interviewee progress their train of thought as though it was a completely novel idea (Seaman, 1999). A good way to get the interviewees to provide rich information is to ask them reflexive questions about their task or to ask them to describe how they would approach their work (Hove & Anda, 2005). The interviewers should avoid questions that are too detailed or using series of questions with prerequisites as it may be challenging to fulfil these during each interview (Hove & Anda, 2005). Knowing how to approach sensitive topics is also key to conducting a qualitative interview. Some sensitive topics may be in relation to persons competency and failures, opinions about fellow colleagues or customers and financial or economic (Hove & Anda, 2005). These, and other sensitive issues should be approached carefully, often late in the

interview, and with confidentially in mind, being respectful and polite and by avoiding judgemental language and cues (Hove & Anda, 2005). As some of the questions relating to alcohol usage can be rather sensitive, the privacy of the interviewee was guaranteed by the project team. All personable data, including audio files, were handled with care and the team received permission for using the interviewees personal and anonymous data for further research.

In addition to taking notes, using a tape or video recorder may be necessary to document the rich data provided by a semi structured qualitative interview (Hove & Anda, 2005). The appropriate tool should be chosen based on the level of detail that is intended to be gathered and how using such tools affects the interviewee and the interview process (Hove & Anda, 2005). A good compromise would be to use a tape recorder as it is often viewed as less intrusive by the interviewees and it provides more data than simple notes, even when the interviewer is well qualified in taking notes (Hove & Anda, 2005). Further tools can be used to improve the interview process. Visual artefacts can be used to maintain the interviewer's engagement and to provide more rich data, and to help the interviewers find a topic to ask follow-up questions (Hove & Anda, 2005). In a software development setting using visual tools may also be necessary as software concepts, tools and applications can be hard to visualise without them (Hove & Anda, 2005). The project work utilized visual representations of the application in a form of a paper prototype or concept. This concept was free for the interviewee to peruse and explore in hand during the interview process. A digital tape recorder was used to document the interview as well as taking some written notes.

Finally, it is important to report the results of the qualitative interview process in an appropriate manner (Hove & Anda, 2005). Describing the interviewees, their numbers and how they were selected is important for good reporting. The number of interviews should be well recorded followed by data regarding their duration and locations. The number of interviewers and their roles should be well documented. All tools, artefacts and guides used during the interview should be also presented when reporting the interview process. (Hove & Anda, 2005) The interview data was presented to the customers accordingly, with data about the interviewees documented in accordance to the University of Oulu research permits. The interviewees all agreed to be a part of the research process if their data was not personalized nor identifiable. The three interviews ranged from 50 minutes and 33 seconds to 33 minutes and 34 seconds with the average length of interviews being just over 39 minutes. In the first portion of the interview, some basic data of the interviewees were gathered. The interviewees were all students of the university of Oulu faculty of information technology and electrical engineering and had experience in software development. The interviewees were selected from faculty students because they were easily approachable. Also, using students who had some expertise in software development could also provide more information about the design elements of the application and function as potential users of the application. All interviewees were under the age 30 and were white Finnish males. They were recruited for the interview from fellow students that were known to the project members from prior studies and relations and were compensated by purchasing coffee, tea, and pastries from the University cafeteria.

3.2.1 Qualitative interview analysis

The interviews were analysed by listening through the audio material several times over and taking notes about any issues mentioned regarding usable behaviour change techniques and user retention strategies. Also, as the study is conducted as qualitative

research, any discernible information about the interviewee's motivations, opinions and general attitudes towards the topic and concepts were documented. This information was used to find out which of the discussed techniques and strategies were valued the most. The interviewees' different backgrounds and attitudes toward alcohol consumption were also noted as they provided valuable information about what kind of end users they could represent. The background differences between the interviewees were analysed and compared to find out how their backgrounds affected their views. It was also noted that the interviewees all had prior expertise in software development through their studies. It was, thus, important to analyse how they emphasized their views on between behaviour change techniques and user retention strategies. User retention strategies are often discussed in software development as the relate to usability and ease-of-use.

3.3 Additionlink.fi discussions

The second data gathering method was to look at a popular online discussion forum to see what kind of requirements can be identified from discussions between online users. The second data gathering method was chosen to provide further new data for this study. The discussion forum selected for this research was Additionlink.fi ("Additionlink.fi", n.d.), a Finnish online support forum for people concerned or suffering from substance abuse. In addition to the forum the website provides links to helpful sites in relation to alcohol use and other addiction. The website is owned by A-Clinic foundation ("A-Clinic Ltd", n.d.). Representatives from A-Clinic and Additionlink.fi were asked for permission to use their website and any comment posted in it for use in this study. The study was given permission to use the website and forum for research after going through A-Clinic's internal research permission process. From Additionlink.fi, two separate sub-forums were selected for research. One aimed at people wanting to outright quit drinking called *We quitters* (Me lopettajat) and another sub-forum directed at people wanting to reduce and monitor their drinking habits titled *We reducers* (Me vähentäjät).

3.3.1 Additionlink.fi content analysis

The content analysis was conducted in a similar manner as performed by Burri, Baujard and Etter (2006) when studying the content of a French language online smoking cessation webpage. Burri, Baujard and Etter (2006) collected comments made to the web page during a selected month. These comments were coded by sorting them into categories and coding them. When a single comment covered several categories, a code was created to correspond each identified category. The authors documented the usernames of the authors of each comment analysed. Each category was then counted to find out the number of comments they contained. Burri and colleagues (2006) were able to identify 17 categories and sorted them by the number of comments they contained and what kind of discussions they pertained to. These categories were analysed to find out what kind of themes were discussed in the forum and what kind of topics were important for people trying to stop smoking. (Burri, Baujard & Etter, 2006.)

Several comments posted on the forum between the 1st of November 2019 and 31st of January 2020 were documented on a separate Excel sheet and analysed for their relation to behaviour change techniques and user retention strategies that could be used in a mobile application. This period was chosen as Christmas and New Year's Eve were both times when people would be struggling with alcohol use and recovery. Further, January in Finland is commonly used as a sober month challenge that could also provide interesting discussions. The collected messages were then catalogued in separate tables

based on what sub-forum they were collected from and whether they were in relation to behaviour change techniques or user retention strategies. The comments were identified by a direct hyperlink to the comment in the forum and an excerpt of the comment that drew the conclusion for the reference. This way, if a larger comment contributed to several different themes, they could be reduced in size to be better traced to the individual sentence that drew the conclusion. Further, if single sentence or statement was seen referencing to multiple strategy or technique it was listed in the table multiple times to separate the different strategies and techniques. The strategies and techniques used for this analysis were taken directly from the Tables 1 and 2 as presented previously. The comments, and their corresponding themes, were not only analysed based on numerical values of occurrence but general themes and patterns were identified to provide qualitative rather than quantitative data. Furthermore, as very few comments discussed mobile technologies directly, qualitative analysis into the individual comments was used to understand the underlying requirement, needs, or motives behind the comment to provide usable themes in relation to both mobile technologies and the behaviour change techniques or user retention strategies used in these. The next chapter discusses the empirical results from the data gathering and analysis methods presented in chapter 3.

4. Empirical Results

This chapter presents the main empirical findings from the qualitative research done for this study. First the concept interview results are presented with each interview process detailed. After this, the content analysis results into the Additionlink.fi forum is presented. Separate chapters provide informative tables that detail the main findings from the two sub-forums. Further, some example comments are presented to give a reference point into to the empirical analysis process.

4.1 Concept interviews

To maintain the anonymity of the interviewees they are named as James, Thomas, and Robert in this study. Each chapter presents the main results of each of the individual interview. Then a chapter collects the main findings of all the interviews to present the main themes discovered from the interview process.

4.1.1 James' interview

James admitted to consuming alcohol typically once a week with the purpose of achieving intoxication. James did not believe he had any kind of drinking problem but noted that there were some individuals with moderate drinking problems in his immediate social circle. He believed that alcohol consumption had caused these people issues with friends and family members. When asked about potentially using an application to monitor his alcohol usage, James doubted receiving any benefit from the using such tool. James felt, however, that it might be beneficial for other people. James believed that abstinence was the most suitable solution for a person with a legitimate problem with alcohol usage. He also noted that there was some social pressure in his social circle to drink and that admitting to alcohol reduction might cause some "amusement" amongst his friends. James noted that he had reduced the consumption of beer to reduce carbohydrate intake but not in the specific desire to reduce alcohol consumption. He also mentioned that presenting scientific advice was beneficial to induce alcohol reduction.

After being introduced to the concept examples James noted that he liked the use of goal setting in the form of challenges. He noted that the presented data could be tailored to, for instance, present daily data instead of weekly progression. Notifications were seen as a positive. According to James, social support in the form of a chat function was not seen as necessary for the application. Using an avatar to take advantage of customisation and boosting motivation and self-efficacy was not seen as an important feature worth exploring. When asked about his suggestions for the application, James noted that showing mere raw data was not beneficial. Instead, the information should be presented in a form that was most easy and fast to deduce. Further, he felt that self-monitoring should be as effortless as possible to enact regular use.

4.1.2 Thomas' interview

Thomas told he was consuming alcohol only once per month on average but noted that use in these instances was heavy and with the specific intent of intoxication. Thomas was a former smoker and had reduced smoking a few years back after noticing performance related issues because of smoking, such as trouble catching breath and elevated pulse. He

currently used alternative nicotine products such as nicotine spray, nicotine lozenges and snus. Thomas had noticed that despite trying to reduce tobacco use his daily nicotine use had instead increased with nicotine products. He had documented his current and past nicotine and tobacco use because. Thomas did not believe he had any problems in alcohol use but noted that nicotine use was beginning to be rather expensive. Thomas noted that monitoring the expenses from alcohol use may also be useful for some people.

During the interview Thomas noted having two friends that he believed had an alcohol problem. One of these friends consumed several servings of beer every day. The other friend engaged in intoxication seeking drinking sometimes two or three times a week. Neither of these friends had a regular job. As such, the effects of regular consumption of alcohol had yet to cause any social or work-related issues. In the Thomas' social circle, social drinking was very common, but he did not himself find any pressure to drink from others. In fact, it was stated that in his immediate social setting, reducing alcohol might be met with support and encouragement. The use of a diary was discussed and noted as potentially being beneficial for documenting nicotine or alcohol usage. Ease of use in use of such diary was important. Thomas was not familiar with any health or reduction application other than a sleep monitoring application on his smart phone and smart watch. He did not believe using said application had any effect on their sleep, even though seeing the data about their sleep was rather interesting. The sleep application might have been more beneficial if it had presented some scientific data. Also, receiving guidance from the application for using the device and application was potentially beneficial.

Thomas did not like notifications in the concept application. He insisted that if notifications were used there had to be an option to turn them off or to change their occurrence. He also noted that it was better that the user could themselves search further information through the application instead of using notifications. Customization, in general was viewed as being very positive as was being able to set own goals. The presented information should also be able to be better targeted to each individual user via user settings. Seeing the information in a graph was more desirable rather than in a table form. This should also be customizable. Visual appeal and usability were highly important to the interviewee. The application should try to get the user to use the application daily to be most effective. Thomas had no strong views on gamification. He did not find social features to be that important but noted that comparing data might be beneficial. Thomas also noted that having a trustworthy organization to back the application would be very beneficial and would improve trustworthiness. He did not believe using an application such as this would have any negative stigma for the user.

4.1.3 Robert's interview

Robert told that he rarely drank alcohol with the goal of getting intoxicated. Robert did not identify any persons in his social circle with problematic alcohol use. Robert most often consumed alcohol in a social setting during special occasions. He was familiar with the use of mobile diaries. Group pressure to drink was a rare occasion for the interviewee and this did not affect his drinking. He noted that the occasion or setting was more important factor for drinking than the group of people associated with the event. Robert did not feel that drinking culture had a big effect on drinking. He felt that social support from friends and relatives was a positive effect on drinking. Robert was well familiar with software utilizing behaviour change in the form of an application designed to reduce laziness. This application utilized feed-back and rewards and required prior motivation and self-efficacy for successful use.

When presented with the example concept, Robert noted that he viewed social support as positive feature for achieving change in alcohol use. Reducing substance use in a group was noted as being more likely to succeed than alone. The ability to tailor feedback in the form of notification was identified, as necessary. Further, Robert noted that it might be beneficial if the application reminded the user to use the application. He noted the graphs and numeric feedback as very useful and that the presented data could be tailored by the user to not only show different kinds of data. Avatar was met with scepticism. Robert did note that when done correctly, an avatar may bring a "human-like" element to the application and thus improve user experience. He felt that customizing the avatar was beneficial for improved user experience and interface between the user and the system. When asked about the potential use of gamification, Robert noted that in certain applications and in certain use-cases gamification may prove useful. Finally, Robert stated that in his opinion, strong motivation to reduce alcohol or substance use was instrumental in successful use of such application. Robert believed that only daily use of the application would lead to behaviour change.

4.1.4 Identified behaviour change techniques and user retention strategies in interviews

The interview data showed that self-monitoring was viewed positively by all the interviewees. Also being able to tailor and customize the application was instrumental for success. This was very heavily tied to the ability to limit the amount of data presented. Whether it be notifications or different types of graphs or tables, all the interviewees wanted to tailor or customize the application. Function, ease of use and intuitive use were heavily tied to one another and were discussed by the interviewees. One user also specifically mentioned the importance of professional appearance and suggested a tool that would help the user in usability. Social support was viewed very positively by two interviewees. Two interviewees believed goal setting would help the users reduce alcohol consumption. Also, two of the three interviewees believed that having scientific data be presented to the user would be very beneficial. The importance of motivation and self-efficacy was mentioned by two of the interviewees. One interviewee believed that seeing the benefits from using such application would help in the user experience and user retention. Notifications were met with mixed response. This would also suggest that customization and tailoring the information is essential. Neither gamification nor the use of avatar seemed to be that important for behaviour change or user retention by interviewees.

4.2 Additionlink.fi analysis results

Vast majority of the discussions in the Additionlink.fi forum were different types of user supporting one another in either reducing, monitoring, or abstaining from alcohol use. It was very typical for a user to create their own discussion board when first starting to use the forum to introduce themselves, their stories, problems, and reasons to use the forum. These discussions would be updated and maintained throughout the users experience when visiting the forum. Many times, these updates would discuss relapses in abstinence or seek advice for tough situations such as vacations or holidays when the user would typically enjoy drinking with friends or family members. Many discussions also pertained to relationship advice or trying to achieve a healthier lifestyle to support recovery. Many of the discussions into relationships did, however, involve alcohol related concerns, especially to spouses not wanting to reduce alcohol consumption or already recovering commenters suffering setbacks because of partners.

From the discussions several themes could be discerned to offer requirements for an application. As an example, user Varjoilija made a comment that roughly translates into: "It is better to proceed one situation at a time. It keeps your mind healthier!" (Varjoilija, December 18th, 2019, *We quitters*). As another example. The user V-tyyli commented on 5th of January 2020 in the *quitters*' forum: "Hey Putkis (username)! You have almost 1000 days full. Congratulations!" From analysing these comments, we can identify that Varjoilija is suggesting a form of action planning to help tack future troublesome situations one situation at a time. V-tyyli in turn, is presenting a reward to another user for successfully maintaining abstinence for 1000 days. Action-planning and giving out rewards are both identified as one of the behaviour change techniques from previous research (see table 1).

Not every discussion, however, provided usable information that could be dissected for a requirement used in a mobile application. Many of the discussions were very general and topics were broad. Further, it was also noticeable that the *reducers'* forum contained a lot of more general discussion and social interaction not directly related to reducing alcohol consumption. This meant that there was a large disparity between the usable comments from the *quitters*' sub-forum and the *reducers'* sub-forum. From the *quitters*' forum 211 behaviour change techniques were documented and analysed versus only 84 from the *reducers*' sub-forum. Furthermore, identifying user retention strategies was more challenging as very few comments directly discussed using any specific technology or applications. Most of the comments that did give insight to user retention strategies were discussions relating to actual alcohol abstinence programs such as the Alcoholics Anonymous. These comments were usually debating on the pros and cons of such programs and how successful they were in the long run. As an example, on the 31st of January the username Rahvas1 commented on the *quitters*' forum:

> "Personally, when I do partake in the groups, I try to choose a group that has good spirit and positive recovery attitude. Still, I cannot choose the people who join the group, but I can change my own attitude and that is the best thing you can do." (Rahvas1, January 31st, 2020, *We quitters*)

Analysing this comment specifically for user retention techniques in a mobile application, there is a want to control the group of people you interact with to maintain a positive attitude and change of success. Using this in a mobile application environment, the user wants to control the information he receives from the application to have the best chance of success. He may also want to limit the amount of data or interaction he has with the application or any social interaction made possible with said application. There were also other types of comments that could be construed to provide a requirement that is adaptable to behaviour change application. Onneli47 notes that: "There truly is so many good things to enjoy in life without requiring any additional help from alcohol" (Onneli47, 18th January 2020, *We reducers*). From this comment we can analyse that the commenter perceives there being several benefits from reducing or abstaining from alcohol. This relates to the user retention strategy 'Perceived benefits from use'. If this user were to perceive any benefits from using the behaviour change application, they would likely continue using it in long term.

From the *quitters'* dedicated forum 23 mentions of user retention strategies were identified. From the *reducers*' forum section, 14 were analysed. This means that there were 295 instances of behaviour change theories and 37 instances of user retention strategies analysed from both sub-forums.

4.2.1 Identified behaviour change techniques

Table 3 shows all the identified behaviour change techniques from the Additionlink.fi forum. The most identified technique was self-monitoring. Most commonly users would update their personal discussion boards with successful goalposts in their reduction. As such, these types of comments were far more common in the *quitters'* sub-forum than the *reducers'* sub forum. As Additionlink.fi is a discussion board dedicated to helping people discuss and support one another with alcohol reduction, it was only natural that coping skills were mentioned commonly. Although in this case, it was more commonly discussed in the *quitters'* sub-forum. This may be because people who are only reducing or monitoring their alcohol usage do not believe to have the same need to plan difficult situations as those with the goal of abstinence. Social support was also very common occurrence in both sub-forums. It should be noted that Additionlink.fi is a form of social support itself. In the discussions, users would often provide encouragement to people in tough situations.

Table 3. Identified behaviour change techniques in each sub-forum.

Behaviour change technique	***We quitters***	***We reducers***	**Total**
Self-monitoring	54	16	70
Coping skills	29	11	40
Social support and comparison	27	8	35
Boosting self-efficacy/motivation	23	11	34
Giving out rewards for success	21	8	29
Goal setting and review	17	8	25
Action-planning	12	9	21
Cognitive bias retraining	7	11	18
Providing additional support	7	0	7
Identity change	4	2	6
Links to written material	5	0	5
Tailoring	3	0	3
Providing information about alcohol use and reduction	2	0	2
Providing feedback	0	0	0

In both forums, many people expressed the lack of or need to be motivated to succeed in their goals. Users would also often give out rewards to one another in the forms of smileys or emojis when successful in their goals. People did often discuss their goals, especially during sober month challenges. Sometimes users would share their approaches to difficult situations hoping that other users would learn from their personal action planning. Cognitive bias retraining came up when people discussed changing their attitude towards alcohol. This was more common in the *reducers'* forum as in that forum people were keener on changing how and in what setting they consumed alcohol. Identity change was surprisingly not often discussed. In the *quitters'* forum some discussions included links to helpful programs and, sometimes also, to written material. Tailoring was only really mentioned in relation to existing programs for abstinence. Providing feedback about behaviour change was not mentioned as it was too specific to behaviour change and technology.

However, many comments pertaining to giving out rewards and providing social support offer a similar role in a forum setting.

4.2.2 Identified user retention strategies

As mentioned, identifying user retention strategies was rather challenging. As technology was almost never directly discussed, strategies relating to mobile technologies were not mentioned at all. These included professional and aesthetic design, providing help with using the system, using unique smartphone capabilities, and tailoring the design of the application. Table 4 shows the number identified user retention strategies in each sub-forum.

Table 4. The identified user retention strategies in Additionlink.fi forum.

User retention strategy	***We quitters***	***We reducers***	**Total**
Perceived benefits from use	4	8	12
Tailoring the information	5	0	5
Ease of use	3	2	5
Feedback on content	3	1	4
Rewarding use	2	2	4
Limiting the amount of data presented	3	0	3
Openness/transparency	2	0	2
Function	1	0	1
Intuitive use	0	1	1
Professional and aesthetic design	0	0	0
Providing help in use when needed	0	0	0
Utilizing unique smartphone capabilities	0	0	0
Tailoring the design	0	0	0

Perceiving a benefit from reducing alcohol consumption or going forward with an alcohol reduction or abstinence program was mentioned in several comments. In relation to existing alcohol support programs, a need to modify or tailor the program to better suit everyone was discussed. Ease of use was mentioned indirectly with comments discussing using exercise equipment or just how much effort there is to make a comment to the forum in question. Feedback on content was mentioned by users venting about frustrating situations or in relation to existing alcohol programs. Rewarding use was discussed in relation to alcohol and weight reduction programs. Also, some users wanted to remove certain types of content from alcohol abstinence programs. Mainly this meant not wanting to hear or read about religion. Openness and transparency were an also a grievance in some of the programs. Function and intuitive use were mentioned in relation to other kind of technologies.

5. Findings and Discussion

The goal of this study was to identify requirements for a behaviour change application to reduce and monitor alcohol consumption. As such, the main research question was constructed as:

> What requirements can be identified for mobile behaviour change application for alcohol reduction and intervention?

After researching previous scientific work into mobile applications and alcohol reduction, the main research question was further refined into two sub-questions. These two were:

1. What kind of behaviour change techniques should they utilize?

2. What kind of user retention strategies should they utilize?

From the previous research and interviews and qualitative research conducted for this study this chapter will try to answer these questions.

5.1 Choosing the behaviour change techniques

From the review fourteen behaviour change techniques were identified. These behaviour change techniques are presented in table 3. From these, self-monitoring received the most support from both interviews and forum comments. Self-monitoring was mentioned in the interviews as a usable tool both in general self-monitoring health applications and in the specific, alcohol reduction concept application. Coping skills came out as an important behaviour change technique from analysing the discussions in Additionlink.fi forum. However, there were differences between each sub-forum in the occurrences of coping skills. The *quitters*' forum discussed coping skills more than the *reducers*' forum. Suggesting that as a requirement, coping skills are more important for people trying to achieve total abstinence than those just trying to monitor and reduce their drinking. The interviewees did not mention coping skills during the interviews. However, no feature utilising coping skills was used in the concept discussed during interviews. Being able to live with alcoholism and the associated cravings is an important tool for abstinence and alcohol reduction (Cohn et al., 2011; Suffoletto & Scagleone, 2018; Tofighi et al., 2019).

Receiving social support for alcohol reduction also gained support when analysing the interview data and forum comments. It was discussed frequently in forum discussions and was mentioned by the two other interviewees. Boosting self-efficacy was only mentioned by one of the interviewees. In forum discussions self-efficacy was however a relatively common discussion issue. The ability of a person to believe in their success played a key role in achieving a permanent behaviour change (Cohn et al., 2011; Crane et al., 2015; Hoeppner et al., 2017; Mubin et al., 2016).

Giving out rewards for success in behaviour change was not mentioned in the interviews and the associated gamification was not seen as beneficial. However, in forum discussions giving out rewards was a frequent occurrence. Many users congratulated each other and sent emojis and motivational messages to persons who were able to achieve their goals. The case may be that these small rewards mean very little to people not experiencing problems regarding their own usage but to people combatting the issue every little reward and motivation boost counts. This was also supported in Crane and colleagues' paper

(2015). Being able to set goals was mentioned by all the interviewees and was commonly represented in Additionlink.fi forums. It seems natural thus, that people who want to achieve a change in their lives would set intermediate goals to ease their road to success. Also, in relation to alcohol use, being able to set goals and monitor one's progress is beneficial for long term behaviour change (Attwood et al., 2017; Crane et al., 2015; Garnett et al., 2015; Mubin et al., 2016). This was also evident from reading the *We quitters'* sub-forum comments.

For a recovering alcoholic or a person wanting to reduce their consumption, action-planning how to tackle hard situations would be beneficial (Garnett et al., 2015; Garnett et al., 2019). Action-planning did come up when analysing the forum discussions. Action-planning, as with coping skills, was not mentioned by interviewees. Likely because they had no experience in trying to reduce alcohol use. The interviewees did however note that, in some situations there was pressure to drink from their peers in a social setting. Cognitive bias retraining did not come up in interviews. In forum discussions many of the comments identified as a form of cognitive bias retraining was in relation to learning how to consume alcohol differently. Many people wanting to reduce alcohol had taught themselves not to want to drink in certain situations or social settings. This suggests that cognitive bias retraining can be used to both learn to avoid alcohol cues and learn to drink alcohol differently (Garnett et al., 2019). The interviewees all mentioned the importance of certain social settings as cues to consume alcohol. In fact, even the interviewee who, based on their background information, drank the least, did so in a specific social setting.

Identity change was not a common topic in either discussions or interviews. It may be that as a concept, identity change is too complex to come up in discussions and to be easily applied to mobile application. Links to written materials was a feature in the concept application discussed with interviewees. One of the interviewees was concerned on how these links were provided to the user while the others had no strong opinions. The forum discussions rarely contained links to other sources, though. This may be because the forum itself provides links for additional support and outside sources in its layout. This was also the case with providing information about alcohol use. It did not come up in concept discussions and forum users did not share scientific links to one another in either sub-forum. Tailoring the behaviour change techniques was discussed in forums in relation to changing the type of information presented in existing intervention programs. Even in interviews it was considered as being more important to user retention than behaviour change. Providing additional support was a rather vague behaviour change technique and was hard to tie to any specific discussion or mobile application feature. Providing feedback did not come up in discussions. The notification tool and avatar in the concept application that utilized feedback were not popular features. Interviewees considered them as an annoyance rather than a useful tool and would thus hurt user retention. However, this may be due to the individual implementation of the concept application and could be better implemented in other applications. In forum discussions such tools were too technology specific to be identified as a separate topic compared to giving out rewards or social support.

In the review the role of family was not discussed. However, in empirical data the role of family members, partners, and friends were widely discussed. In the interviews two of the interviewees believed that family and friends could be a positive affect for alcohol reduction and support in using a mobile application as a tool. In the forum discussion family and partners were discussed extensively. Especially when one family member was trying to abstain or reduce consumption while others continued to drink. Further research should be conducted on how family and friends effect the use of a mobile application for alcohol reduction.

The first sub-question was: “What kind of behaviour change techniques should they utilize?” To answer this sub-question; self-monitoring, teaching coping skills, social support and comparison, boosting self-efficacy and motivation, goal setting and reviews, giving out rewards when achieving these goals, action-planning and cognitive bias retraining received the most support from the empirical data. While the other techniques may prove useful in a mobile application, they should be further studied by using prototype applications and appropriate user tests. This is especially true for providing feedback from behaviour change as it was met with scepticism in the interviews.

5.2 Choosing the user retention strategies

Maintaining user engagement by utilizing user retention strategies was identified as the second sub-question. The review identified thirteen user retention strategies. These are presented in table 2. Further analysis from qualitative interviews and content analysis showed that all but one of the strategies were mentioned in forum comments or by interviewees. Utilizing unique smartphone capabilities as mentioned by Garnett and colleagues (2015) did not come up in empirical data.

Naturally ease of use is the most important user retention strategy. Ease of use was well represented in scientific papers (Attwood et al., 2017; Crane et al., 2017; Garnett et al., 2015) and was widely discussed in the interviews. As in developing any successful software system, usability and ease of use are imperative (Attwood et al., 2017; Crane et al., 2017; Garnett et al., 2015). Further, the proper function of the application and intuitive and rewarding use were tied to ease of use within the interview data. Ease of use was also mentioned in forum comments but not in direct relation to mobile applications. Several comments in the forum provided feedback on existing intervention programs. This would suggest that being able to provide feedback is also a valid retention strategy for a mobile application.

Being able to tailor the design and information presented in the application was very important in the eyes of the interviewees. This was also supported when users of Additionlink.fi commented about existing abstinence programs. The users felt that some content was more beneficial for them than others. Analysed discussions also suggested being able to identify benefits from use was an important retention strategy. This was not discussed by the interviewees, but they did not themselves suffer from alcohol use related issues. Limiting the amount data presented in the application screen was viewed as very important for user retention and usability by the interviewees. Not only to make the user interface less cluttered, interviewees also felt that some types of data, such as graphs, were more informative than others. Professional and aesthetic design and being able to receive help with use was highly valued by one interviewee. Openness and transparency did not come up in interviews and was only mentioned when discussing organizations behind certain alcohol abstinence programs. Utilizing unique smartphone capabilities was not discussed in the forum discussions. In fact, mobile phones or applications were not widely discussed in the analysed comments.

To answer the second support research question “What kind of user retention strategies should they utilize?”; almost all the retention strategies presented in Table 2 should be used. Being able to utilize unique smartphone capabilities was not an important topic in the empirical data. The unique smartphone capabilities being tied to GPS tracking, phone calls and text messages were not supported by the empirical data, although especially text messages were widely discussed in scientific data (DeMartini et al., 2018; Suffoletto et

al. 2014; Suffoletto & Scagleone, 2018). Wearable technologies were mentioned in interviews but were outside of this study's scope and thus disregarded.

5.3 Compiling the requirements for the mobile application

The main research question was: "What requirements can be identified for alcohol reduction mobile applications?". From the sub-questions we can deduce that a successful mobile application for reducing or abstaining from alcohol use should utilize suitable behaviour change techniques such as self-monitoring, coping skills, social support and comparison, boosting self-efficacy and motivation, goal setting and reviews, giving out rewards, action-planning and cognitive bias retraining. Table 5. provides a list of example features that can be used to fulfil these requirements.

Table 5. Example behaviour change techniques.

Behaviour change technique	**Example technique**
Self-monitoring	Having a diary where the user can maintain a log of all the alcohol servings they have consumed during the day.
Coping skills	The application provides a list of fun activities the user can do on weekends instead of drinking.
Social support and comparison	Having a chat feature where sponsors can provide support to users.
Boosting self-efficacy/motivation	Sending motivational messages and images to the user.
Goal setting and review	The user can set a goal successfully partaking in sober October.
Giving out rewards for success	When achieving a successful goal, the user is sent a link to a relaxing video.
Action-planning	Providing a list of polite ways, the user can decline to accept an offered drink.
Cognitive bias retraining	Showing the user data about negative effects of alcohol use.
Providing additional support	Asking if the user would like to receive text messages with beneficial information.
Identity change	Sending the user recipes for healthy non-alcoholic drinks and beverages.
Links to written material	Providing links to publicly available scientific papers that discuss substance abuse.
Tailoring	Being able to change the applications language and turn off unwanted features.
Providing information about alcohol use and reduction	Providing a link to national guidelines about normal alcohol consumption.
Providing feedback	Providing an e-mail address where the user can send suggestions and report bugs.

It is also imperative to maintain user engagement. Continuous usage of the application is important to achieving meaningful and long-term behaviour change (Garnett et al., 2015;

Suffoletto & Scaglione, 2018). To achieve this, applications should take advantage of user retention strategies that take into consideration ease of use, function, intuitive and rewarding use, professional and aesthetic design, being able to provide feedback and tailor and customize the design, information and data, having tools to help with usability, being open and transparent about the application and any organization associated with it and lastly, users should be able to perceive some kind of benefit from using the application.

The review also suggested that the behaviour change techniques used should be based on pre-existing behaviour change theories such as Transtheoretical Model (Glanz & Bishop, 2010) or Health Believe Model (Champion & Skinner, 2008). Many of the identified behaviour change techniques, such as boosting self-efficacy, self-monitoring and goal setting are key concepts in these behaviour change theories (McAlister, Perry & Parcel, 2008; Glanz & Bishop, 2010). It should be then noted that when developing an application for behaviour change and especially when directed towards alcohol reduction, the application should be open about its behaviour change techniques and theories and provide evidence about beneficial effects. This would also support the openness and transparency that was identified as one of the user retention strategies. According to Crane and colleagues (2015) no application available during their research mentioned any scientific evidence that their use would provide beneficial behaviour change. Although, not within the scope of this study, it is also important that the application is developed using suitable development model. One such model was presented by Spring and colleagues (2013). Developed to be used with health applications, model such as this should also prove beneficial when used with alcohol reduction application.

6. Conclusions, Implications and Limitations

To conclude, behaviour change techniques such as self-monitoring, having social support features or teaching the user coping skills were found to be important for a successful behaviour change application for reducing alcohol usage. It was also important that the application maintain user engagement by taking advantage of beneficial user retention strategies. Some of these strategies were aesthetic design, ease-of-use or being able to give feedback on using the application. The study also suggested that developers should be aware of the behaviour change theories that their techniques are based on and present evidence and data about the successful use of the application. Also, it was noted that the application should be build using an appropriate development model for behaviour change application.

The goal for this study was to create a list of requirements that can be used as guidelines when developing a behaviour change application for alcohol reduction and intervention. Of course, an application cannot fully satisfy all the requirements of the different types of user groups, however, the requirements here took into consideration three types of users, some of them being people who were actively trying to reduce or abstain from alcohol use. In the future, more emphasize should be taken into consideration about not just the user's own behaviour and change but also the effects of the user's surroundings. Especially the effect of partners and family members and how an application could be built to take into consideration the people around the user who do not use the application. Also, further research and testing should be conducted into already existing applications to find out which of the requirements identified in this study are worth further development and which are not as instrumental for permanent behaviour change in relation to alcohol.

The small number of interviewees was a limitation for this study. Also, all the interviewees were students from University of Oulu Faculty of Information Technology and Electrical Engineering. The selection of interviewees could have been more diverse in relation to age, education, employment, social status, and gender. Conducting further interviewees with more varied and greater number of interviewees could provide more variable information about developing a behaviour change application in this context. Further, forum discussions were used to get data from people who were actively tackling alcohol use instead of other more substantial empirical data gathering methods. Further qualitative interviews should also include these types of potential users of the application.

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Appendix A. Qualitative interview document and questions

Substance abuse – Concept review interview with user

Tuomas Liimatta(PM), Johannes Riekki, Lauri Laitinen

Ensimmäinen Osio: Juomistavat ja kokemukset

First Part: Drinking habits and experiences

Minkälainen on tyypillinen alkoholinkulutuksen?

What is your typical alcohol consumption?

Oletko havainnut ongelmia alkoholin käytössäsi? Kerro niistä?

Have you noted any problems in your alcohol use? Tell us about them?

Oletko havainnut ongelmia läheisesi alkoholinkäytössä?

Have you noticed any problems with the alcohol use of your close ones?

Kerro niistä?

Tell us about them?

Miten seuraat alkoholinkäyttöäsi?

How do you follow your alcohol use?

Mitä mieltä olet käyttöösi seuraamisesta esim. päiväkirjan avulla?

How do you feel about monitoring your use with for instance, a diary?

Minkälaisessa tilanteessa yleensä nautit alkoholia?

In what kind of setting do you usually consume alcohol?

Tunnetko ikinä ryhmäpainetta?

Do you ever feel group pressure?

Minkälainen vaikutus kulttuurilla on käyttöösi/alkoholin käyttöön yleensä?

What kind of effect does culture have in your alcohol use/use in general?

Tilanne, jossa haluaisit vähentää alkoholin kulutusta: Minkälainen vaikutus lähimmäisilläsi olisi tähän päätökseen?

A situation where you would like to reduce your use: What kind of effects would your close ones have in this decision?

Miten haluaisit ylläpitää tätä vaikutusta?

How would you like to maintain these effects?

Miten haluaisit mitigoida tätä vaikutusta?

How would you like to mitigate these effects?

Mitä päihdeseuranta/tukipalveluita tunnet.

What kind of substance use/support services do you know?

Oletko tutustunut/käyttänyt niitä? Jos Kyllä kerro lisää palveluista.

Have you ever familiarized/used these? If so, tell us more about these services?

Mitä aktiviteetti/äly monitorointi palveluita tunnet/olet käyttänyt?

What kind of activity/monitoring services do you know/have used?

Jos Kyllä kerro lisää palveluista, niiden vaikuttamisen tavoista ja niiden vaikutuksista itseesi.

If so, tell use more about these services, their behavior change techniques and effects on you?

Minkälaisia vaikutuksia näillä on ollut käytökseen/elämäntapoihin?

What kind of effects did these have in your behavior/lifestyle?

Toinen Osio: Konseptin esittely haastateltavalle

Second Part: Presenting the concepts to the interviewee

Kolmas Osio: Palaute konseptista ja ideoita kehitykseen

Third Part: Feedback from the concepts and ideas for development

Mitä mieltä olet sovelluksen eri ominaisuuksista, tutustu vapaasti niihin lähemmin ja kysy lisää.

What do you think about the different features of the application? Feel free to explore them in more detail and ask questions.

Puuttuuko sovelluksesta mitään? Kerro lisää...

Is something missing in the application? Tell us more…

Onko ominaisuuksia, josta et pidä? Kerro lisää...

Are there features you don't like? Tell use more…

Kuvitellaan että käytät sovellusta: Kerro miten käyttäisit sovellusta? tilanne, määrä etc.

Let us imagine you are using the application: Tell us how you would use it? Setting, time etc.

Mitä mieltä olet pellillisyydestä, tarinallisuudesta, kustomisaatiosta, avatarista?

What do you think about gamification, using story elements, customization, avatar?

Miten haluaisit muokata sovellusta käytön aikana?

How would you like to tailor the application during use?

Miten näet yhteisöllisyyden sovelluksen käytössä?

How do you view the social support in the application's use?

Minkälaisia sosiaalisia vaikutuksia voisit nähdä sovelluksen käytöstä?

What kind of social effects could you perceive from using the application?

Neljäs Osio: Palaute haastattelusta ja ideoita jatkoa varten

Fourth Part: Feedback on the interview and ideas for future

Miten itse tekisit tämän?

How would you yourself do this?

Miten saisi mukaansa tempaavan?

How would you make this more 'catching'?

Minkä tyyppistä tietoa kaipaat sovelluksesta?

What kind of information would you like to receive about the application?

Kokemus haastattelusta (riippuen sensitiivinen aihealueeseen)?

Experiences from the interview (considering the sensitive issues)?

Miksi suostuit haastatteluun?

Why did you agree to partake in the interview?

Arvio, miten tätä tutkimusta/haastattelua tulisi lähestyä? (miten lisää käyttäjiä)

Evaluate how should this research topic/interview be approached? (more interviewees)

Kiitos haastattelusta!

Thank you for the interview!